Chapter 10
Mobility Management Issues for Next Generation Wireless Networks

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ABSTRACT

The next generation networks must support mobility for ubiquitous communication between any two nodes irrespective of their locations. Mobile IP was the first protocol to support mobility. The process of registration in Mobile IP protocol requires large number of location updates, excessive signaling traffic and service delay. This problem is solved by Hierarchical Mobile IP (HMIP) using the concept of hierarchy of Foreign Agent (FA) and the Gateway Foreign Agent (GFA), Mobility Anchor Point (MAP) to localize the registration information. The performance depends upon the selection of GFA or MAP and some key parameters. This chapter discusses several HMIP based mobility management schemes with a comparative analysis of those protocols and proposes an efficient mobility management scheme.

INTRODUCTION

The future generation of networks is expected to be all-IP-based with the ability of seamless inter-working using Internet as the backbone. Users' expectation demands transparent accessibility from any one network to any other globally irrespective of location. There has been a tremendous growth in the deployment of network systems with the dramatic increase in the usage of different wireless technologies coexisting around us. These different systems usually have different characteristics in terms of mobility, bandwidth, latency, frequency and cost. To support mobility, a major task in mobile communication system is to maintain continuity of communication when

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a mobile user/device migrates from a cell of one physical network to another cell of the same or different physical network. This is accomplished by changing the communication channel and control from the old to the new base station and the process is known as call handoff or handover. Each handoff requires network resources to reroute the call to the new base station and adds load to the switching processor. It is even critical to manage the handoffs when a roaming user moves into a dissimilar network with different type of the communication channels and mobility characteristics. Minimizing the number of handoffs during a communication session and minimizing delay in handoff execution are the main tasks in handoff process. Mobility protocols are designed to manage the handoffs efficiently with optimized call handoff strategies so that the perceived quality of service (QoS) does not degrade in mobile communication system.

User mobility is one of the most important criteria that mark impact on the in internetworking and QoS, a key parameter in the design of future networks. Mobility in general, can be classified into three categories, - micro mobility, macro mobility and global mobility. Micro mobility is the movement of the mobile node (MN) within the Base Stations (BS) in a subnet which occurs very frequently. Macro mobility is the intra-domain mobility of the MNs among different subnets in a single domain or region. Global mobility refers to the movement of MN from one network domain to another that may be heterogeneous in nature. Micro-mobility protocols may be classified based on some key parameters such as protocol name, hand off type, paging support, traffic inside the network, load balancing, scalability, robustness, QoS support, and traffic direction. Mobility management protocols based on IPv6 show superior performance over IPv4 based protocols. Among the existing protocols, Hierarchical MobileIPv6 (HMIPv6) is the most robust and scalable supporting both macro and micro mobility. Route optimization, a built-in feature of MIPv6, is a common technique to overcome the problem of triangular routing which is responsible for the increases in handoff latency. HMIPv6 protocol reduces this overload and improves handoff delay by separating the local mobility from global mobility. Along with the standard HMIP protocols, we consider some advanced micro-mobility protocols such as PHMIP(2003), RHMIP(2003),MBBU(2003), DHMIP(2004), MHMIP(2004), FFH-MIP(2004), MIFA(2004), SIGMA(2004), HMIP-MPLS(2007), SHMIP(2007) etc. for our analysis. Extensive analysis has been carried on the issues such as handoff latency and signaling overhead. The analysis compares the merits and demerits of various schemes and recommends the need of a scheme which may accumulate the merits of most of the existing schemes. In this process, analysis of the two mobility models- Free flow model and Random walk model are pertinent. The over all study proposes a network with a new mobility model which may yield a better result than any other existing scheme by removing the binding update with the HA.

BACKGROUND

The fundamental problem for a mobile host (David, 1999) is to have seamless connectivity and continuous reachability and therefore, it must retain its identifier while changing its location. The network addresses are associated with a fixed network location. If a packet's destination is a mobile node, then each new point of attachment made by the node is associated with a new network corresponding to a new IP address, making transparent mobility impossible. Mobility is not supported in the IP layer by traditional IP. Mobile IP enables mobility transparent to applications and higher level protocols such as TCP.

Mobile IP (RFC 2002), a standard proposed by a working group within the Internet Engineering Task Force, was designed to solve this problem by allowing the mobile node to use two IP addresses:

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